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MEMORANDUM TO: Chairman, Research, Development, and Production Review Board

FROM: Chief, Engineering Division, OC

SUBJECT: Cubical Quad Antenna, Proposal for Investigating Properties of, by 25X1

The subject proposal is forwarded herewith for consideration at the 5 October meeting of the RD&PR Board.

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September 28, 1955

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Dear George

Confirming our recent discussions, we would be glad to undertake an analysis of the "Quad" type antenna to determine its relative performance. The "Quad" antenna consists of a radiator wire formed into a square approximately one-quarter wavelength on a side. The square loop is fed at the center of the bottom side with a balanced transmission line. A complete "Quad" antenna includes a radiating element as described and a similar parasitic reflector element which is tuned for optimum performance by means of a reactance stub. According to reports in the literature, this type antenna has been used with considerable success by amateur radio operators in both the 10 and 20 meter amateur bands.

The work required to provide the information you requested would include a theoretical analysis of the "Quad" antenna and, also, model tests of the antenna to determine its operating characteristics and power gain.

Our work in analyzing the antenna from a theoretical viewpoint would include the computation of antenna patterns based on an assumed idealized current distribution and reflector current ratio and phase angle. Integration of the radiation patterns would be undertaken to provide a value of power gain based on these assumptions.

We would also construct a model of the "Quad" antenna for operation at a frequency of approximately 500 mc. Tests would be made on this model antenna to determine the amplitude and phase distribution of the current on the radiator and reflector elements and the impedance versus frequency characteristics. Measurements would be made of the current amplitude and phase distribution on at least three frequencies to permit an analysis of the band width over which the antenna will provide good performance. Analysis of the current measurements on the reflector element would be made with several different tunings of the reactance stub so as to determine the optimum tuning.

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After the model test analysis outlined above is completed, we would make further computations of antenna patterns to determine the effect of the departure from the idealized current distribution on the radiation pattern and power gain. This work would be carried out on two or three frequencies to determine the band width characteristics.

In addition to the work outlined above, we propose to make field intensity measurements of the relative gain of the "Quad" antenna compared to a half-wave dipole. These measurements would be made at an outdoor location available for this type work near Falls Church, Virginia. We have adequate field testing facilities to obtain the relative gain figures which will provide a verification on the computed gain figures arrived at on the basis of the current distribution measurements.

It is our understanding that you also wish to determine the effect of operating two "Quad" antennas with very close spacing on two different frequencies with a frequency ratio of approximately 2:1. Tests would be made to determine the effect of such operation by means of current distribution measurements and also field intensity measurements of the relative power gain.

The program as outlined above would include a reasonable amount of experimental work to improve the antenna performance by slight changes in dimensions or the arrangement of the radiators. The effect of different radiator to reflector spacings would be explored, as well as different locations of the second antenna which is to be mounted nearby to provide a compact antenna for two-frequency operation. We estimate that the work as outlined above can be completed for a maximum fee of $4,000. This would include preparation of a report giving the results of the work and details of the methods used in arriving at the computed and experimental data. We are agreeable to undertaking this work as a task under our present contractual arrangement.

With regard to the time required to complete the work, I believe we can provide you with a final report within two or three months after receiving a go-ahead signal from you.

Yours very truly,

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